

Amendment of Drawings

A proposed amendment to Figure 5 is shown in red ink on the attached drawing sheet entitled “Annotated Sheet.” Specifically, the column 52 is correctly indicated to have a width of W_1 , rather than W_2 .

Applicants enclose a complete set of formal drawings, comprising sheets 1 through 10, each labeled as “Replacement Sheet.” These Replacement Sheets include Replacement Sheet 4, with Figure 5 incorporating the proposed change to the figure.

Attachments: Annotated Sheet

Replacement Sheets

REMARKS

After entry of this amendment, claims 1–52 and 76–81 will be pending. Claims 53–75, previously withdrawn in response to a restriction requirement, are hereby cancelled. Claims 1, 35, 38, and 45, have been amended. New claims 76–81 are added. Support for the amendments and the new claims may be found in the specification, for example, on page 9, lines 6–9; page 9, line 30 – page 10, line 5; page 11, lines 5–16; and page 15, lines 16–21, as well as in the originally filed claims. No new matter has been added.

Applicants note with appreciation that the Examiner has indicated that claim 35 would be allowable if rewritten in independent form. Applicants have amended claim 35 accordingly.

Amendment of Figures

In amended Figure 5, a width of column 52 is correctly indicated as “W₁.” Support for this amendment is found in the specification, for example, at page 11, lines 13–16.

Applicant encloses Replacement Sheets 1–10 including the drawing sheet corresponding to Figure 5 with the proposed amendment. These drawing sheets replace the originally filed drawing sheets.

Information Disclosure Statement

In view of the number of references that were cited, the Examiner requested that applicants identify any specific reference(s) with particular significance. Applicants thank the Examiner for his review of the cited references. Applicants consider all of the cited references to be relevant for the prosecution of this application, and believe, therefore, that all of the submitted Information Disclosure Statements are in compliance with MPEP § 609.

Objections to Claims

Claims 38 and 39 are objected to on the basis of informalities. These objections are moot in view of the amendment of claim 38 to properly depend on claim 37 rather than 33.

Rejection of Claims under 35 U.S.C. § 102

Claims 1 and 4–9 are rejected under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 4,960,728 to Schaake et al. (“Schaake”). Schaake appears to disclose the formation of II-VI films by MBE or MOCVD. See column 1, lines 63–65. Schaake does not teach or suggest the rotation of a substrate during the formation of a semiconductor layer, as recited in amended

independent claim 1. In a horizontal flow deposition reactor, a higher fraction of an element is incorporated at a leading edge of a substrate. The substrate may be rotated during deposition, thus changing the leading edge exposed to gas flow. *See* page 10, lines 1–5.

Applicants submit that for at least this reason, amended independent claim 1 and claims dependent therefrom are patentable over the cited prior art.

Claims 1–3, 19–22, and 42 are rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,841,457 to Bedell et al. (“Bedell”). Bedell discloses the formation of an $\text{Si}_x\text{Ge}_{1-x}$ layer over a single crystal Si layer. *See* column 6, lines 35–46. A subsequent anneal is performed to relax the strained SiGe alloy and to permit interdiffusion of Ge throughout the first single crystal Si layer and SiGe alloy layer. The anneal apparently causes Ge atoms to merely be redistributed within the $\text{Si}_x\text{Ge}_{1-x}$ layer and Si layer. *See* column 8, lines 11–21. Bedell appears to disclose the redistribution of Ge in two layers; Bedell does not teach or suggest reducing an initial compositional variation within a layer, as recited in independent claim 1. Moreover, Bedell is silent regarding the uniformity of the initial composition of the disclosed $\text{Si}_x\text{Ge}_{1-x}$ layer, and certainly does not teach or suggest the rotation of a substrate during the formation of a semiconductor layer, as also recited in amended independent claim 1.

Applicants submit that for at least these reasons, amended independent claim 1 and claims dependent therefrom are patentable over the cited prior art.

Claims 1 and 10–15 are rejected under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 4,914,488 to Yamane et al. (“Yamane”). Yamane does not teach or suggest the rotation of a substrate during the formation of a semiconductor layer, as recited in amended independent claim 1.

Applicants submit that for at least this reason, amended independent claim 1 and claims dependent therefrom are patentable over the cited prior art.

Claims 1, 16–18, and 41 are rejected under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 6,515,335 to Christiansen et al. (“Christiansen”). Christiansen appears to disclose the formation of Ge or SiGe islands on top of a Si layer by, e.g., MBE or CVD. A subsequent anneal causes intermixing between the islands and the Si layer. *See*, e.g., column 5, lines 18–30, column

6, lines 5–15 and 42–46. Christiansen appears to disclose the redistribution of Ge in two layers; Christiansen does not teach or suggest reducing an initial compositional variation within a layer, as recited in independent claim 1. Moreover, Christiansen does not teach or suggest the rotation of a substrate during the formation of a semiconductor layer, as also recited in amended independent claim 1.

Applicants submit that for at least these reasons, amended independent claim 1 and claims dependent therefrom are patentable over the cited prior art.

Claims 1, 22, 23, 31, 32, 34, and 42–44 are rejected under 35 U.S.C. § 102 as anticipated by U.S. Patent Publication No. 2002/0146892 by Notsu et al. (“Notsu”). Notsu appears to disclose forming a Si layer over a SiGe layer by CVD, diffusing Ge into the Si layer to form a SiGe layer, and annealing the layers such that the Ge concentration in the second SiGe layer becomes uniform. *See*, e.g., paragraphs [0101], [0102], and [0113]. Notsu appears to disclose the redistribution of Ge in several layers, rather than within a layer, as recited in independent claim 1. Moreover, Notsu does not teach or suggest the rotation of a substrate during the formation of a semiconductor layer, as recited in amended independent claim 1.

Applicants submit that for at least these reasons, amended independent claim 1 and claims dependent therefrom are patentable over the cited prior art.

Claims 1, 22, and 26–30 are rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent Publication 2004/006744 by Malik et al. (“Malik”). Malik discloses forming a strained SiGe layer by MBE or CVD, and then relaxing it by an annealing step. *See* paragraphs [0013]–[0016]. Malik discusses only changing the stress level of the SiGe layer, and is silent about changing the composition of the SiGe layer. As the Examiner recognizes, Malik does not teach or suggest annealing a semiconductor layer to reduce the initial compositional variation within a layer, as recited in independent claim 1. The Examiner relies on US 2002/168802 to Hsu (“Hsu”) to provide this feature. Hsu discloses annealing a layer structure to diffuse Ge into a Si layer to form a relaxed SiGe layer. *See* paragraph [0008]. The Examiner asserts that the relaxation anneal will reduce the initial compositional variation at least with respect to Ge in some portions of the structure. Applicants respectfully disagree. Hsu, also, is silent about reducing initial compositional variations; Hsu merely employs an anneal to form a relaxed SiGe

film. Moreover, neither Malik nor Hsu teach rotating a wafer during the formation of a semiconductor layer, as recited in amended independent claim 1.

Applicants submit that for at least these reasons, amended independent claim 1 and claims dependent therefrom are patentable over the cited prior art.

Claims 45–49 and 52 are rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,844,260 to Ohori (“Ohori”). Ohori discloses forming an InGaAs layer exhibiting undulation in an upper surface because of cross hatching, and removing the cross hatching by polishing, thereby providing a mirror finish. *See* column 11, lines 4–14. The Examiner asserts that surface unevenness is commonly referred to as haze, citing U.S. Patent No. 6,335,269 to Sato (“Sato”) as support for this proposition. *See* column 9, lines 39–49. Neither Ohori nor Sato, however, alone or in combination, teaches or suggests haze comprising a fine-scale roughness wavelength of less than 1 micrometer, as recited in amended independent claim 45.

Applicants submit that for at least this reason, amended independent claim 45 and claims dependent therefrom are patentable over the cited prior art.

Claims 45 and 49–51 are rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,107,653 to Fitzgerald (“Fitzgerald”). Fitzgerald teaches forming a semiconductor layer, e.g., a SiGe layer, and planarizing a surface of the layer to remove surface roughness caused by dislocations introduced during relaxation. *See*, e.g., column 3, lines 31–39. The Examiner asserts, on the basis of the disclosure of Sato, that this surface roughness results in the formation of a haze. Fitzgerald and Sato, however, are both silent regarding the degree of surface roughness. Neither Fitzgerald nor Sato, alone or in combination, teaches or suggests haze comprising a fine-scale roughness wavelength of less than 1 micrometer, as recited in amended independent claim 45.

Applicants submit that for at least this reason, amended independent claim 45 and claims dependent therefrom are patentable over the cited prior art.

Applicants respectfully request that the application now proceed promptly to examination. Applicants believe that no additional fees are necessitated by the present Response. However, in the event that any additional fees are due, the Commissioner is hereby authorized to charge any such fees to Deposit Account No. 07-1700.

If the Examiner believes that a telephone conversation with Applicants' attorney would expedite allowance of this application, the Examiner is cordially invited to call the undersigned attorney at (617) 570-1806.

Respectfully submitted,



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Title: SEMICONDUCTOR STRUCTURES WITH
STRUCTURAL HOMOGENEITY
Inventor: Westhoff et al.
Serial No. 10/765,372
Atty Docket No.: ASC-066
Attorney for Applicant: Natasha C. Us
Sheet 1 of 1 ANNOTATED SHEET

4/10

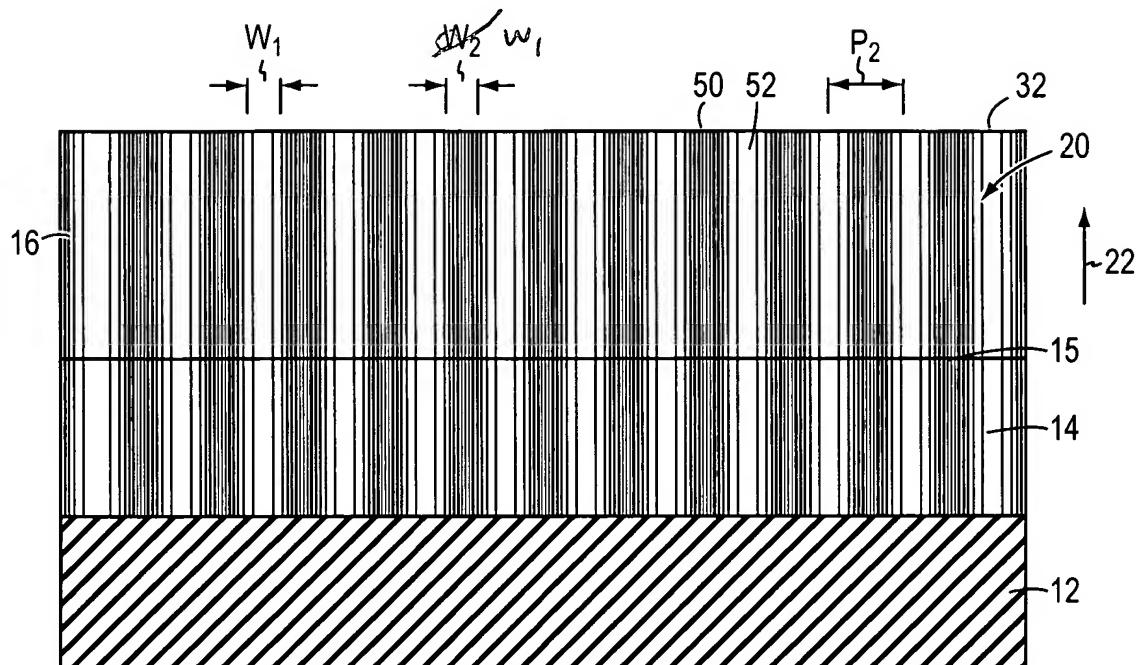


FIG. 5